Analytical performance of a coagulation monitoring system INRatio [point of care] for the determination of INR compared with an established laboratory method and its use in shortening patient treatment time in a tertiary care vascular surgery centre.

Analytical performance of a coagulation monitoring system INRatio [point of care] for the determination of INR compared with an established laboratory method and its use in shortening patient treatment time in a tertiary care vascular surgery centre.

DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT OF THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY FOR THE DEGREE OF MCH VASCULAR SURGERY EXAMINATION TO BE HELD IN 2014

Certificate

This is to certify that “Analytical performance of a coagulation monitoring system INRatio [point of care] for the determination of INR compared with an established laboratory method and its use in shortening patient treatment time in a tertiary care vascular surgery centre” , which is being submitted as thesis requirement for M.CH Vascular Surgery examination of the Dr. M.G.R. Medical University of Tamil Nadu, is a bonafide work of the candidate – Dr. Indrani Sen.

Dr. ,

Professor and Head,

Department of Vascular Surgery,

Christian Medical College,

Vellore, Tamil Nadu

Certificate

This is to certify that the topic entitled "Analytical performance of a coagulation monitoring system INRatio [point of care] for the determination of INR compared with an established laboratory method and its use in shortening patient treatment time in a tertiary care vascular surgery centre" is a bonafide work done by Dr. Indrani Sen, post graduate in Vascular Surgery of Christian Medical College, Vellore. This work has been carried under my guidance and supervision in partial fulfillment of the regulation of Dr. M.G.R. Medical University of Tamil Nadu for MCH Vascular Surgery examination to be held in 2014.

Dr.

Professor and Head,

Department of Vascular Surgery,

Christian Medical College,

Vellore, Tamil Nadu

Acknowledgements

Dr.Sunil Agarwal, Dr. Edwin Stephen, Dr. Sukesh Chandran Nair; without whom this study would not have been possible.

All my colleagues, senior and junior, who co-operated with me in the recruitment of study cases.

Office staff in Vascular Surgery for their help in placing the purchase requests.

The clinical pathology lab team for the technical support.

Contents

TITLE : Analytical performance of a coagulation monitoring system INRatio [point of care] for the determination of INR compared with an established laboratory method and its use in shortening patient treatment time in a tertiary care vascular surgery centre.

DEPARTMENT : Vascular Surgery

NAME OF THE CANDIDATE : Indrani Sen

DEGREE AND SUBJECT : MCH Vascular Surgery

NAME OF THE GUIDE : Dr. Sunil Agarwal
Dr. Edwin Stephen

Abstract

Background:

Point of care (POC/ near patient) testing for measurement of the international normalized ratio (INR) is a technical advance with claims of increased utility and better patient outcomes. This has also been reported to be useful in inpatients to improve time to intervention. This study evaluated the accuracy and precision of the coagulation monitoring system (INRatio) for the determination of

INR compared with an established laboratory method for reducing patient treatment time in the outpatient setting in vascular surgery.

Methods:

A prospective case control design was used to study all patients on oral anticoagulation managed in the Vascular Surgery outpatient clinic. Patients with anemia, haemolysis or lupus anticoagulant positivity were excluded from the study. The POC test result was compared to the reference lab test to check for statistical and clinical correlation. Sample size was calculated based on published literature with a test sensitivity of 87.5%; precision 5% and desired confidence level 99%.

Results:

There were 168 patients tested; 55% were male, the mean age was 45.4(Range 20-75). All patients tested were on anticoagulation with a target INR range of 2-3; 93% were under treatment for DVT and 7% for arterial disease. 60% of the study population was in the target

INR range. Tests were done for statistical and clinical correlation. The INR range obtained by using the test machine was 0.8-7.5 (reference lab 0.8-10), mean INR was 2.22+/- 1.6 (test machine) compared to 2.46 +/- 1.3 (reference lab). The mean absolute difference was 0.79 +/- 0.92 and the mean relative difference was 8.1% +/- 1.03. Data was analyzed using a Bland-Altman plot yielding a mean of 0.738 (SD 0.92) Concordance between the tests was 75% with r^2= 0.52 on linear regression. Using an error grid plot, excellent clinical correlation was seen in 63.8%. In 5.4% a major corrective action was needed but potentially missed if relying on the test machine.

Conclusion:

This test achieved only moderate statistical and clinical correlation. In the presence of a good reference lab, this POC test cannot replace the lab test and hence cannot be used in shortening patient treatment time. The accuracy of the machine is moderate therefore it has potential utility where access to a reference lab is difficult.

Introduction

Vitamin K antagonist are oral anticoagulants which reduce thromboembolic events; clinical outcome being better when patient's international normalied ratio (INR) is maintained in a narrow therapeutic range. This requires regular testing with well timed dose adjustments. Accurate point-of-care devices which provide reliable INR results allow self-testing at the patient's home. This result is then managed by the patient's physician or patients interpret their INR to adjust their medications (self management). Self-monitoring has been demonstrated in systemic reviews to be safe, helping to reduce thromboembolic events, reducing the risk of death and major bleeding especially in specific populations (elderly). Patients spend more time in the therapeutic range of INR. However use of self-testing and self-management differs considerably between countries.

At initiation of oral anticoagulation, INR has to be tested once every three days till it reaches the target level(2-3) after which it can be tested once every week for 2 weeks. If consecutive INR's remain in the therapeutic range for the first month, testing intervals can be longer apart.(1) Some patients may need treatment lifelong- in these patients, testing at least once every two months is required. This requires the patient to give the blood test in the morning of the planned OPD visit. Many patients are not from the same city and reaching the hospital in time to give the blood test is difficult. The test is often not ready by the time the patient is seen in OPD. This delay is inconvenient both for the patient and the treating doctors. It often necessitates a full day spent at hospital which implies loss of wages. Patients who do not stay in the same city may need to stay overnight which is even more disruptive to their routine life. If the INR is low (hypocoagulable), medications have to be increased. If INR is high (hypercoagulable), the patient might be at risk of

bleeding and mediations have to be decreased. The INRatio Prothrombin Time Monitoring system is one of the available point of care instruments for home testing of INR. It has demonstrated very good accuracy, precision and technical reliability for self monitoring by patients. (2) These machines have been in use in other countries USA, Germany, France (3–5) with a backup physician support system. One study in an internal medicine academic clinic showed that use of such a point of care testing can also markedly improve the time to intervention in a hospital setting. (6) We studied this machine for a similar application in a Vascular Surgery unit for shortening treatment time.

Patients and methods

Objectives of the study

1. To evaluate the accuracy and precision of the INRatio point of care anticoagulant monitor system to determine the INR compared with a established laboratory reference.
2. To determine if this system helps in reducing patient treatment time in the outpatient and inpatient setting in vascular surgery.

Study population recruitment

All patients undergoing INR testing in Vascular Surgery OPD are enrolled in the study. Those patients with lupus anticoagulant positivity, those on heparin/low molecular weight heparins, anemia, or haemolysis were excluded. Data was collected in the Vascular Surgery OPD. Sampling was done for consecutive patients / INR's; data collection was

prospective, selection was independent of the results of the index test. The entire sample was verified with the reference standard of diagnosis. Basic patient details like indication for anticoagulation, patient age, sex were also documented. The blood collection was done by the principal investigator after informed consent. The time period between the index (POC) test and the reference standard was less than 3 hours and this was unlikely to change the target health condition between the two tests. The index test was interpreted independently of the reference standard and without knowledge of the result of the reference test.

Sample size calculation was based on the study Taborski U, Braun SL et. Al ; the POC had a sensitivity 87.5 % for a precision of 5 % and a desired confidence level 95% ; the calculated sample size was 168. The test results were not interpreted using clinical data from participants. Un-interpretable test results were excluded from the final

analysis. The numbers of these were noted as machine failure. There was no missing information.

Results and Discussion

There were 168 tests done, results were obtained in 149 patients. In 11%, the test result was not obtainable as the result reported was an “error”.The age range of the patients tested were 22-75 with an average range of 45 years. There were 75 females. the most common indication for anticoagulation was deep vein thrombosis. Only 60% of the patients reached target anticoagulation levels during the study period. The range of INR detected in the tests was 0.75 to 10 both for the laboratory and INRatio. These results are represented in Table.1

Table.1: General characteristics of patients

General characteristics	N= 168
Male	55%
Mean age	45.4
Diagnosis	DVT 93% Arterial Disease 7%
Target INR	2 to 3
% population in Target INR range	60

Statistical analysis

The mean INR WAS 2.46 with a standard deviation of 1.3 when checked in the lab. The INRatio monitor yielded mean values near 2.22 with a standard deviation of 1.6. The range of INR measured in both machines covered the clinically relevant range from the 0-10 which reflected that the test machine also picked up the patients who were out of the therapeutic range.

The mean absolute difference [INR reference – INR self-monitoring] and the (MRD) relative difference ([INR reference – INR self-monitoring] / INR reference) for the whole group of data, mean The Hill accuracy rating of the MRD% is very good (6.58–9.25), good (9.32–11.86), acceptable (11.93–14.54), marginal (14.60–20.28) and very poor (20.34–26.99). The mean absolute difference was 0.79 +/- 0.92 and the mean relative difference was 8.1% +/- 1.03

which was in the very good range indicating that the differences in the test results from both the machines show good concordance.

\

Table 2: Basic statistical comparison

	Reference Lab	**INRatio**
INR Mean +/-SD	2.46 +/- 1.3	2.22+/- 1.6
INR range	0.8-10	0.8-7.5
Mean absolute difference	0.79 +/- 0.92	
Mean relative Difference	8.1% +/- 1.03	

The clinical and biological validity of the results were then analyzed by using a Bland Altman plot. The difference of results of the two methods were plotted against their average, this represents the limit of agreement among the two techniques and the difference of the averages ± 1.96 standard deviation (SD). We also calculated the Passing and Bablok linear regression which demonstrated agreement of methods (slope and coefficient of correlation). The concordance correlation coefficient was also calculated to assess the extent to which observations fall on the 45º line through the origin. The Pearson correlation coefficient- a measure of precision – to study how much every observation deviated from the best fit line; was calculated. Cb was also measured, this was a bias correction factor that tested how much the best fit line differred from the 45º line that passed the intersection of the axes and thus was also an estimate of accuracy.

The Bland and Altman plot (Fig. 1) is a graph representing the difference (bias) when comparing the average of the two

measurements: INRatio and the laboratory reference. A visual inspection disclosed a trend good agreement between the two machines with very few values lying outside the 2SD mark even when the INRvalues were in the higher range. The linear regression revealed a moderate deviation from the best-fit line with a slope of 0.7. This was confirmed by a concordance correlation coefficient of 0.52 at a significance of 0.01. The concordance coefficient was 75%.

Table 3: Lab- machine concordance 75.2%

		Reference Lab test			
		Hypo	Normal	Hyper	Total
Test machine INR	Hypo	45	7	2	54
	Normal	10	41	5	56
	Hyper	3	10	26	39
Total		58	58	33	149

Figure 1. Bland Altman plot

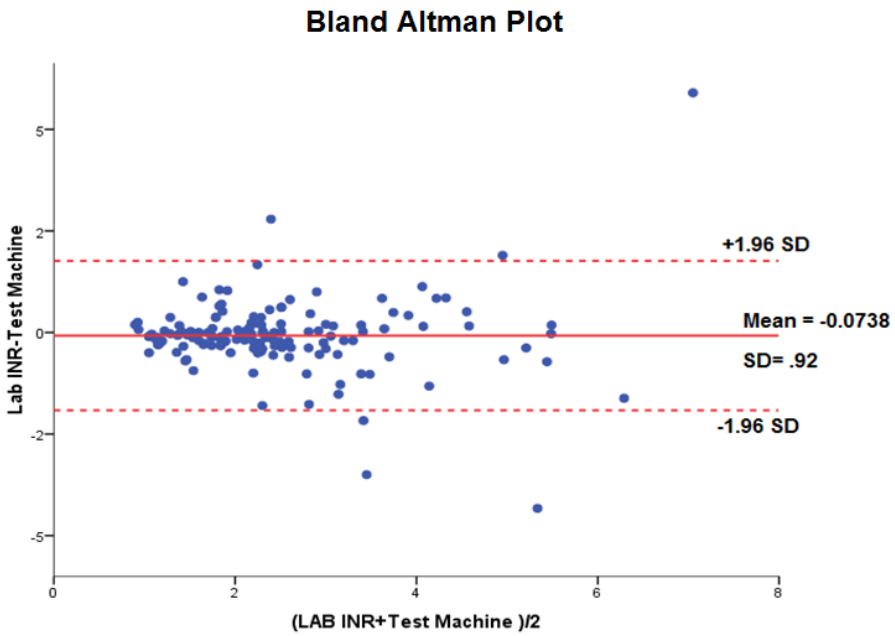
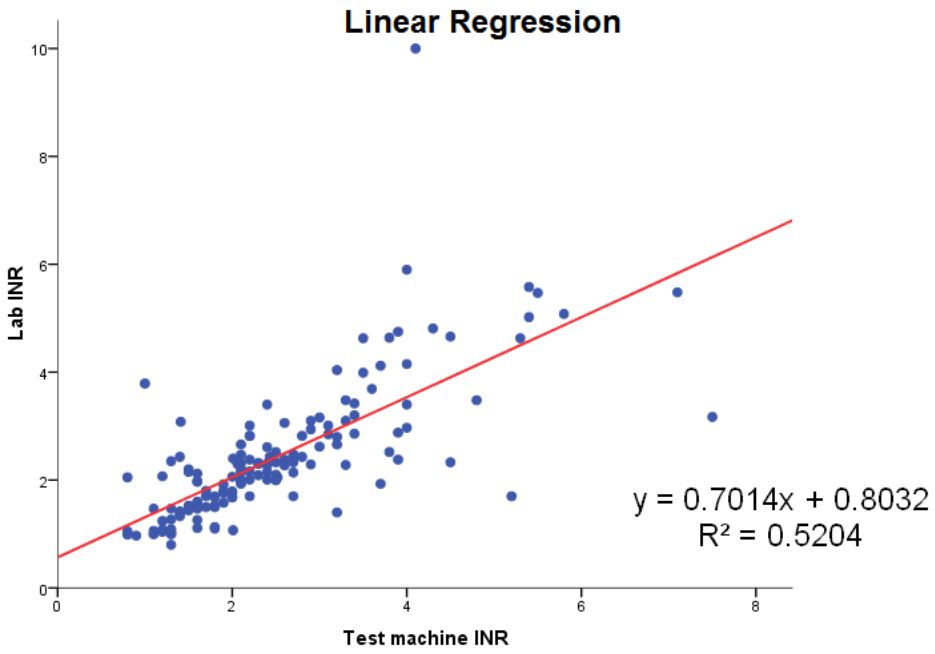


Figure 2: Regression analysis



Correlation coefficient 0.721 (Significant at 0.01)

The next section of the analysis dealt with formulating an error grid plot based on the clinical ranges of significance. This assessed the short term effect of a erroneously high or low result on the clinical decision. The grid assessed the percent of patients who were at risk of receiving an incorrect dose if the test machine INR was used. This yielded a result of only 70 % being in the best fit zone. 5% of patients would be in the clinically dangerous zone where they would risk over or under anticoagulation and thus be at risk for bleeding or thrombotic complications. In 30%-which was a significantly large proportion, the test results did not correspond to the lab values. This is similar to reports from other studies- the interpretation of this has been different though. As they are not in the clinically dangerous zone, more frequent retesting often brings these patients into the best fit zone. However if the machine is being used instead of the lab standard, the test results would be “inaccurate” in 30% - this is not clinically acceptable.

Hence the conclusion would be that in the absence of the testing facilities or a lab standard, there is potential utility of the INRatio machine as a means of alternative testing ; but in centres with a certified lab the lab results would be superior in clinical management.

As the machine overall had poorer clinical utility; the secondary objective of the machine being able to shorten treatment times cannot be assessed.

Table 4: Error grid plot results

Legend	Clinical implication	Percent results
Zone A	Clinical decision same, difference in values clinically irrelevant	63.8
Zone B	Corrective action in the same direction, inadequate but clinically irrelevant	21.4
Zone C	Corrective action necessary but not taken, clinically relevant	9.4
Zone D	Dangerous situation as major corrective action needed but missed	5.4

The cost of both tests were similar- the new test being marginally more expensive, the cost of the Reference lab test in our setup is 220INR – the breakdown of costing for the test machine is depicted in Table 5.

Table 5: Cost accounting

Sl no.	Cost (Rs/-)
INRatio machine	17850
Test strips(291) 48 strips cost 8064/- 4 boxes needed	28224
Misc(batteries)	100
Total	46174
Cost per patient	274

Literature review

Treatment with acitrom or warfarin (oral anticoagulants) as is required for various clinical conditions. Long term oral anticoagulation therapy is commonly prescribed following artificial cardiac valve placement, atrial fibrillation or venous thromboembolic disease. Regular monitoring for the prothrombin time and the international normalized ratio (INR) reduces the incidence and risk of bleeding and thromboembolic events. Strict adherence to the small therapeutic range is difficult; overdosing or under treatment is frequent with adverse clinical outcomes. Monitoring is usually managed by general practitioners; some centres have speciality anticoagulation clinics or hemostasis units. The coagulation cascade depicted in Figure 1 is tested by various tests of anticoagulation- these are classified as in the following table. (Table 4)

Table 6. Tests of coagulation

Screening tests	PT/ INR PTT Thrombin time Fibrinogen
Factor assay	Chromogenic factor assays Factor VIII , Inhibitor assay Von Willebrand factor assay
Platelet function test	Light aggregrometry Nuclear assay PFA-100 analysis Flow cytometry
Prothrombotic workup	Anti-thrombin Protein C assay Protein S, APC resistance Homocysteine Antiphospholipid assay
Fibrinolsis tests	D- dimer Plasminogen Lupus anticoagulant
Gene test	Fac V, II- G20210A mutation
Miscellaneous	ACT ADAMTS Bleeding time Ecarin clotting time Anti Xa / thrombin generation tests Thromboelastogram Heparin induced thrombocytopenia assay

The classical coagulation cascade was studied as the extrinsic intrinsic and common pathways but we know that these do

not function separately. These are now being studied as extrinsic tenase, intrinsic tenase and prothrombinase.

Figure 3: Coagulation Cascade

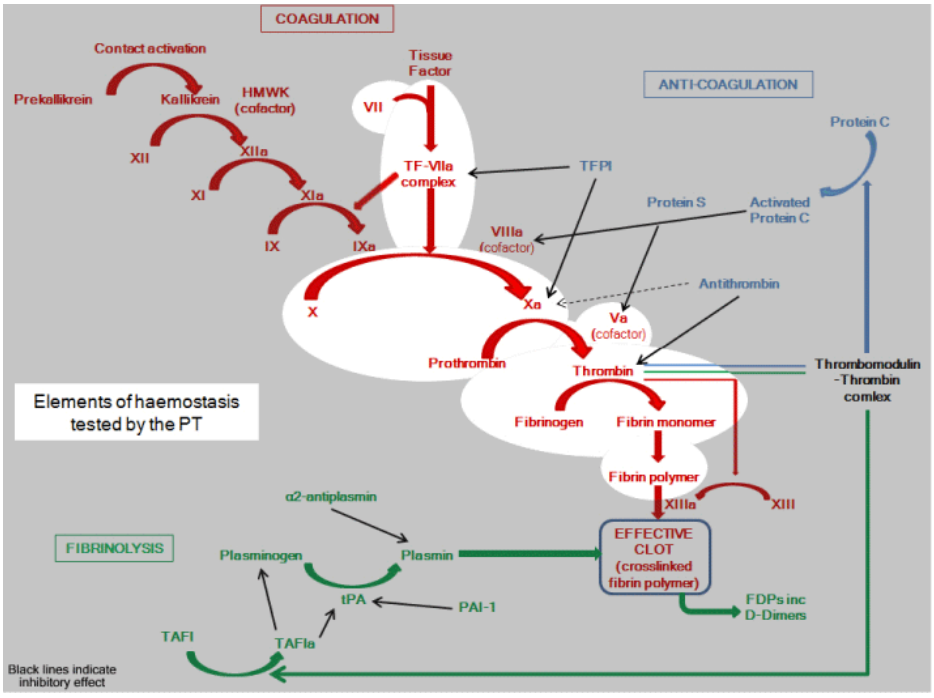
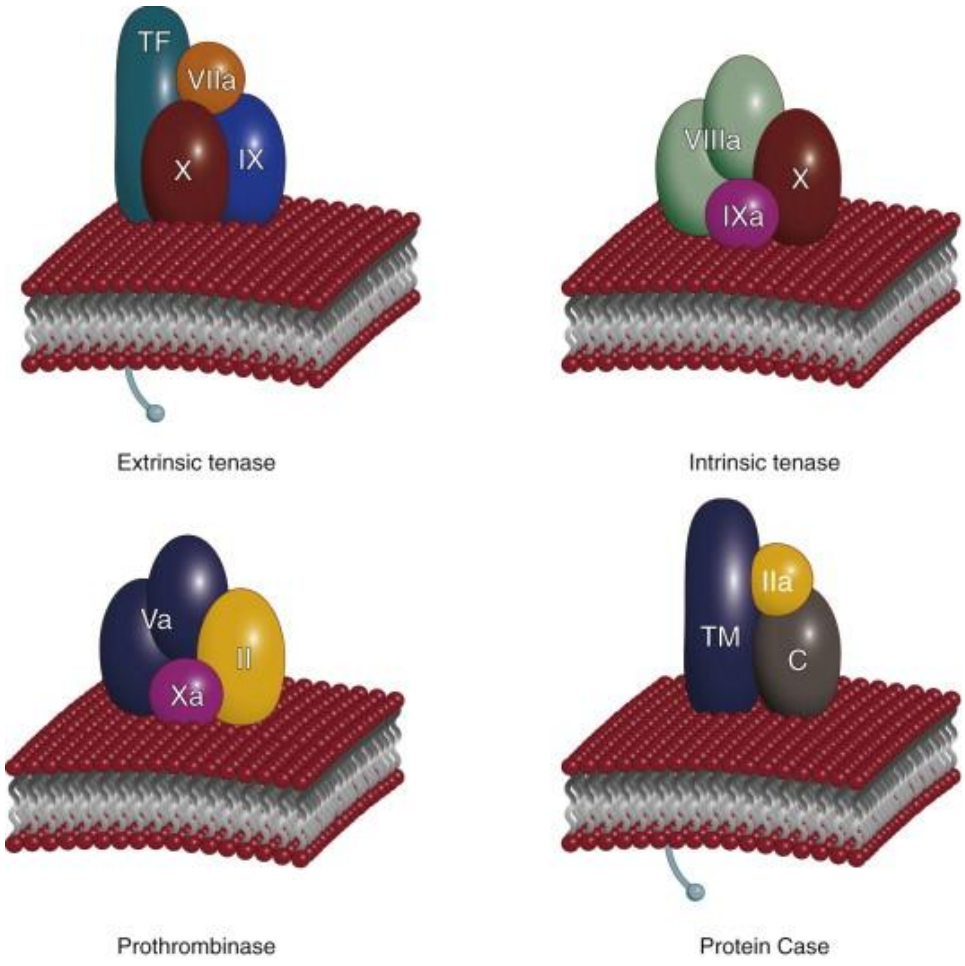


Figure 3: Coagulation Cascade: current understanding



Different coagulation tests study different aspects of this complex in- vivo coagulation system. The prothrombin time was initially described by Quick in 1935. This is the time in which a fibrin clot forms after adding tissue factor (thromboplastin), phospholipid and calcium to decalcified, platelet poor plasma. Thromboplastin or tissue factor(TF) is a substance found in plasma that converts prothrombin to thrombin. They used to be extracted from rabbit brain or other organs and also contained phospholipids. These are species specific. Modern laboratories use recombinant human TF. This is re-lipidated to provide phospholipid.

The PT depends on the levels of functional/active factors of the extrinsic and common pathway. The factors tested are Factors VII, X, V, II and fibrinogen. The clotting cascade is depicted in the diagram below. Other than laboratory factors, there are pretesting variables which can affect the result of the PT.

At 37°C, platelet poor plasma is mixed with thromboplastin and an excess of calcium chloride (25mM) is added. The time from addition of calcium to formation of a fibrin clot is the PT. It can be detected manually or by an automated system. Abnormalities of this test can occur in a variety of conditions.

This is represented diagrammatically in the following figure,

Various factors can affect the PT and these are listed in Table 7. Other than this , patient factors, pretesting factors and test reagent factors can also affect the test- these are discussed in the subsequent sections.

Figure 4: Prothrombin time – the test

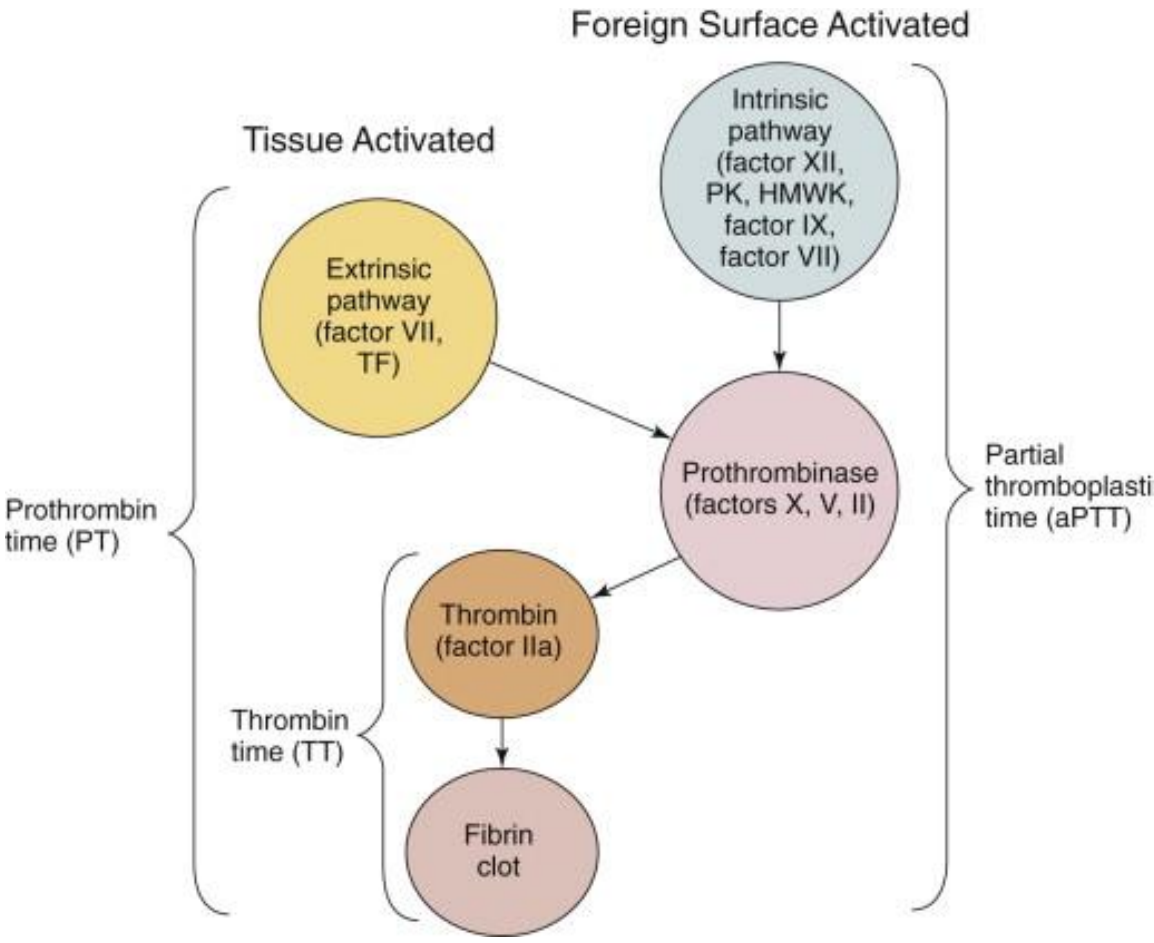


Table 7. Factors affecting PT

PT alone increased	Factor VII deficiency
Increased PT + aPTT	deficiency of Vitamin K
	antagonist to Vitamin K
	liver disease
	other coagulation abnormalities
	malabsorption
	Unfractionated heparin, Direct thrombin inhibitors
	clotting factor deficiencies
	VKORC1 gene mutations
	Dilutional coagulopathy
	Lupus anticagulant
Decreased PT	Administration of rVIIa

Pre-analytical variables, quality control, external quality assurance are important for results that are reliable, reproducible and accurate. These are listed in the following table.

Table 8: Other factors affecting PT

Physiological variables	Pathological states
Technique of phlebotomy	Volume of sample
Proper collection tube	Adequate storage
Proper handling	Avoid undue agitation
Proper centrifugation	Correct transport conditions
Avoid delays in processing	Correct identification, labeling

There are many physiological differences between patients. These may sometimes be outside of lab control but being mindful of them can help in minimizing lab result variations by either ensuring proper handling or reagent use. Some of these other variables are

1. The vitamin K dependent clotting factors are low at birth reach adult values at six months of age. They may reduce in old age as well.

2. Pregnancy changes the composition of body fluid compartments and causes a thrombophilic state with increase in the levels of FacVIII, vWF, Fac II, Protein S and fall in platelets

3. High bilirubin orhyperlipidemia forms a turbid plasma – this does not allow proper functioning of the optical density analyser.

The reference range can vary due to changes in the source of Tissue Factor (human, rabbit) ; automatic or manual- method of testing; optical/ mechanical method of end-point determination . Each laboratory sets up a normal range but usually, the normal plasma prothrombin time is between 13-15 seconds.

The differences of sensitivity is the sensitivity index. Different thromboplastins are calibrated against al WHO International Reference Preparation (IRP). This provides a International sensitivity index or ISI. Human brain extract was used initially- adsorbed bovine plasma was added – this optimised the content of non-vitamin K dependent coagulation factors. Subsequent WHO IRPs contain no adsorbed bovine plasma. The WHO reference thromboplastin has an ISI of 1.0.

The calibration of a thromboplastin is against a reference of the same species. Prothrombin Time is performed in duplicate

for each thromboplastin . Following this the mean for each pair is calculated. 20 normal donors not on anticoagulants and 60 patients on oral anticoagulants for 6 weeks or more are tested. A less than 10% difference among duplicate samples is acceptable, otherwise , the test needs repeating.

Using a double-log paper these results are plotted. The reference sample is plotted on the Y axis and the test plasma is plotted on the X-axis. The slope of the line of best fit is the international sensitivity index. A good thromboplastin has a ISI near 1.0. A high ISI makes the thromboplastin less sensitive to minimal changes PT.

The International Reference Thromboplastin standardizes the test. However different machines (coagulometers) use different methods of end-point detection leading to a lot of variations of PT. Hence a local calibration of thromboplastins is recommended. It is advisable to test batches of plasma samples with known INRs against a laboratory-specific

thromboplastin with the coagulometers which will be used to derive the PT.

The INR is the ratio of a test sample compared to a normal PT (derived from the log mean normal prothrombin time from normal donors) corrected to the thromboplastin sensitivity.

A nomogram correcting PT ratio to INR can be used for any thromboplastin with a known ISI.

The INR value for a patient not on vitamin K antagonist should be 1.0. The therapeutic range for anticoagulation varies according to the indication..

International Normalized Ratio (INR) or prothrombin time self monitoring devices, are battery-operated devices for use by patients at home to monitor and dose adjust oral anticoagulant therapy. Self-monitoring permits frequent measurement and self-management increases the time that anticoagulation is within a therapeutic INR range while decreasing the incidence of thromboembolic or hemorrhagic events. This is considered medically necessary if long term anticoagulation with frequently determination of INR values is required and the treating physician prescribes home testing. In the context of self-monitoring many INR measuring devices have been developed.

The CoaguSense™ Self-Test PT/INR Monitoring System (CoaguSense, Inc., Fremont, CA), ProTime® Microcoagulation System (International Technidyne Corporation, Edison, NJ), CoaguChek® XS System for Patient Self-Testing (PST) (Roche Diagnostics-North America, Indianapolis, IN), CoagCare® (ZyCare® Inc, Chapel

Hill, NC), and Alere™ INRatio®/INRatio2® PT/INR Monitoring Systems (Alere Inc., Waltham, MA) are approved for use by the (U.S.) Food and Drug Administration (FDA) . The prescribing physician is responsible for the training and ongoing management of individuals selected for self-monitoring.

The machine used in this study is INRatio. INRatio2 is the newest coagulation monitor manufactures by HemoSense.

Figure 5: INRatio monitor

Testing. INRatio2 yeilds Prothrombin Time (PT) and International Normalized Ratio (INR) results in less than a minute using 1 drop of blood from a fingerprick. It is easy to use, and has integrated quality controls with every test.

It does not need for external liquid quality control or extra strips or separate device to check electronic controls. Test Strips do not require refrigeration, are individually wrapped

The device has a single button operation, 1 step auto turn-on with strip insertion, large LCD screen, easy to read digits, icon based interface and long battery life.

A Test Strip is inserted into the INRatio2 monitor, a drop of fresh whole blood from a fingerstick is applied to the test strip and the monitor performs the PT and 2 quality control tests (normal and therapeutic) simultaneously, and determines whether the controls are within

preset limits. If they are, strip integrity is verified, and the monitor reports the PT test result. If they are not, the monitor displays an ERROR message.

The machine is 5.9 inches (15.1 cm) in length, 2.9 inches (7.4 cm) in width; 1.8 inches (4.6 cm) in height; 9.3 oz. (263 g) weight.

Figure 6: Method of testing

The blood is drawn into the test area by capillary action where it mixes with reagents that cause coagulation.

Figure 7: Test strip mechanism

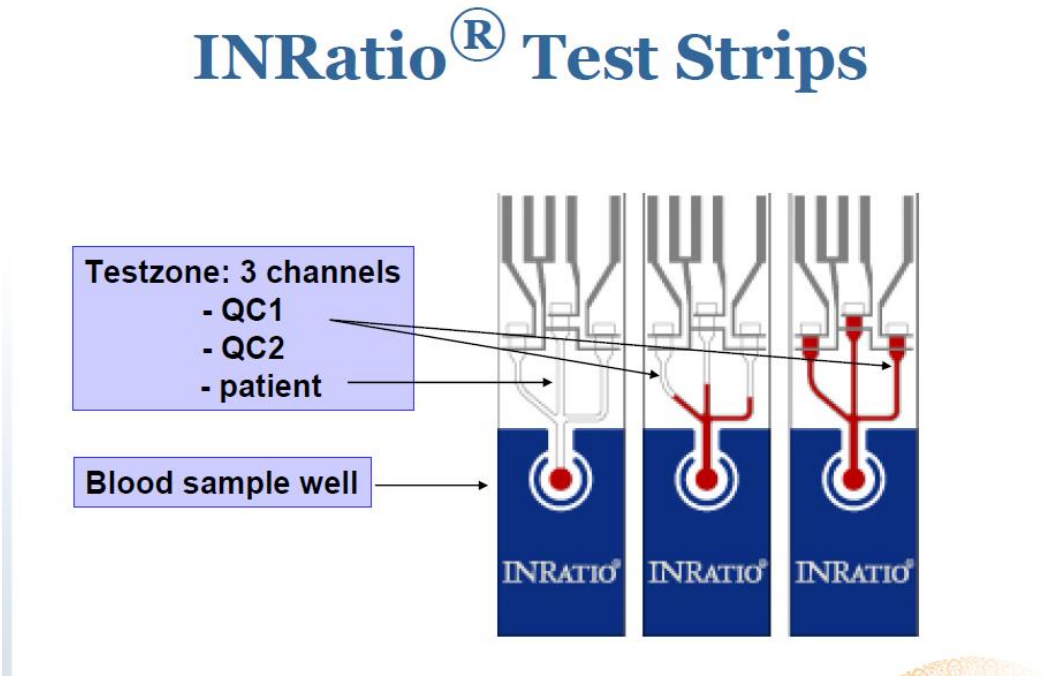
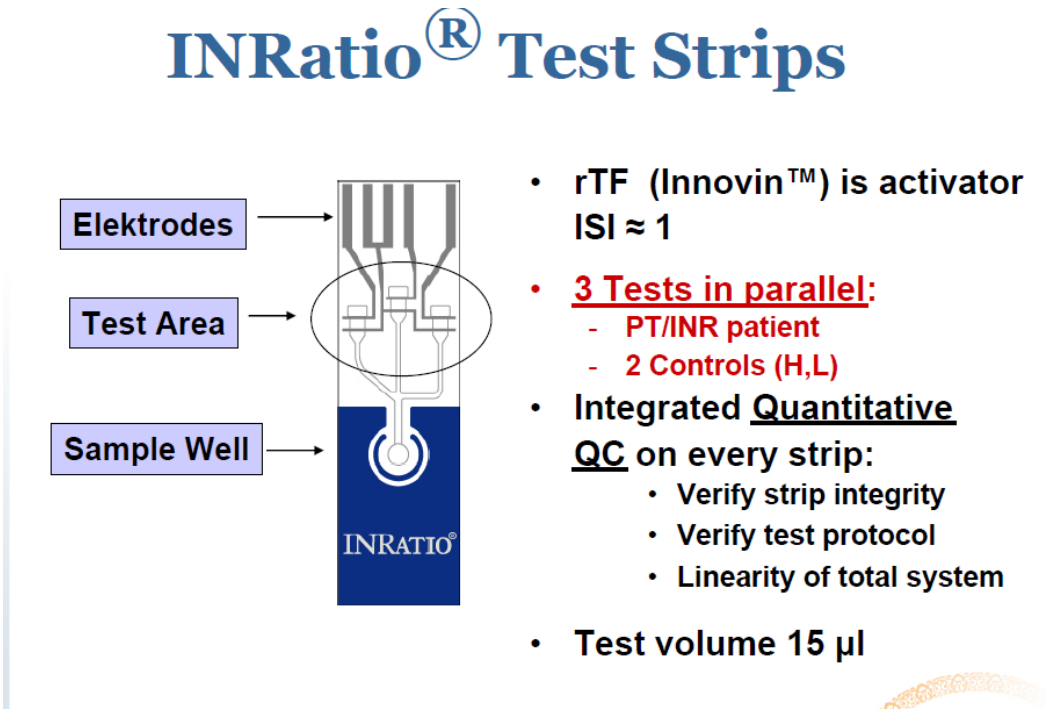
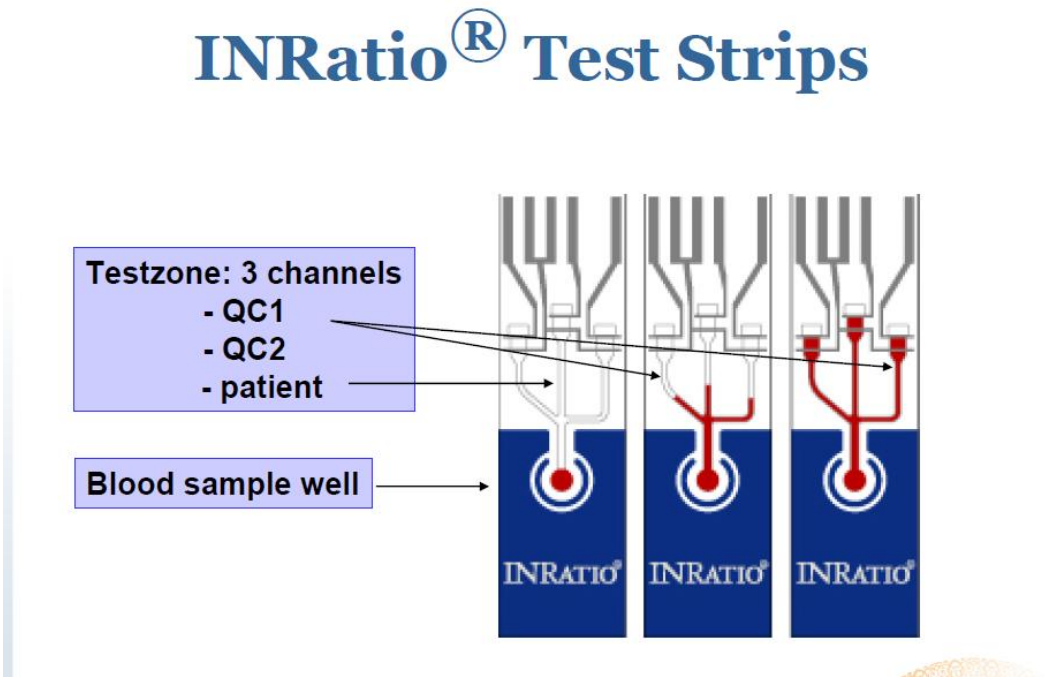


Figure 8: Test strip parts



The test results are displayed in less than 60 seconds. The machine performs electronic system self-test automatically.

Figure 7: Test strip quality control



The system is self-maintaining, only routine cleaning is needed. It has a simple interface which can record change of time, date, and the result. It uses 4 AA batteries or optional power adapter as a power source. It can store up to 60 test results in memory. It has a built-in port for printing / electronic communication.

INRatio detects clotting by measuring change of the electrical impedance of the sample of blood occurring with the conversion of fibrinogen to fibrin. The PT microcoagulation pump agitates the sample till clot formation. This is followed by optic detection of the reduction of motion in the blood as it clots. Magnetic alternating fields are used in the Coagucheck- iron particles on the sample strip move ; at the time the blood clots, the movement of blood particles stops and this is read by the machine. Different machines detect clotting by mechanical (AMAX) or optical methods (ACL, MLA, STA, Sysmex) when using plasma.

Figure 9: Mechanism of testing INR

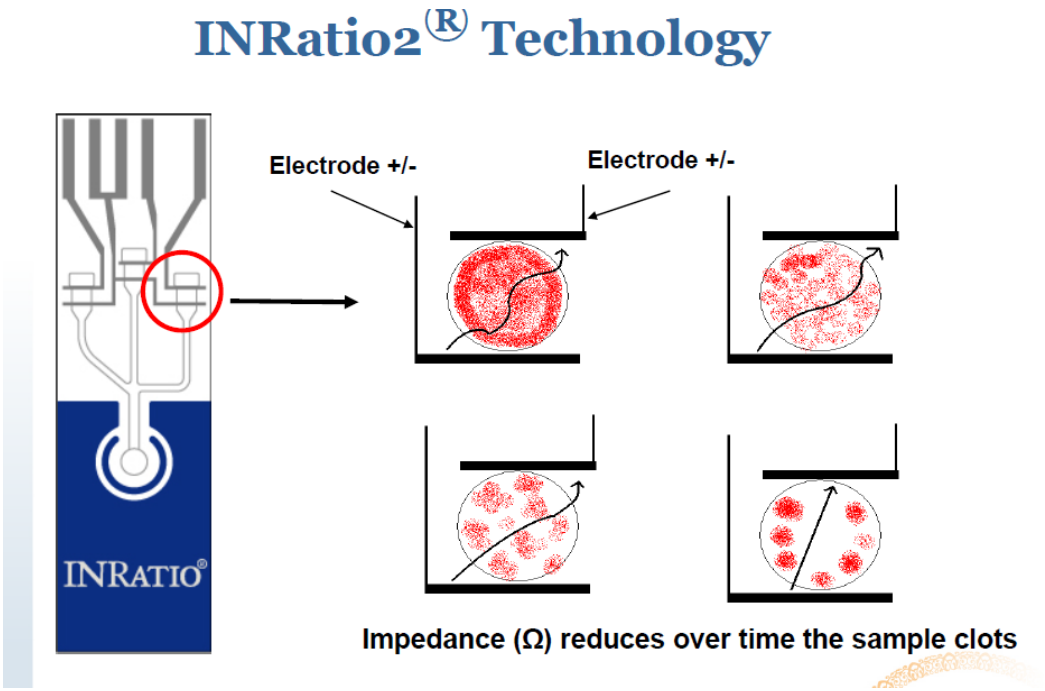
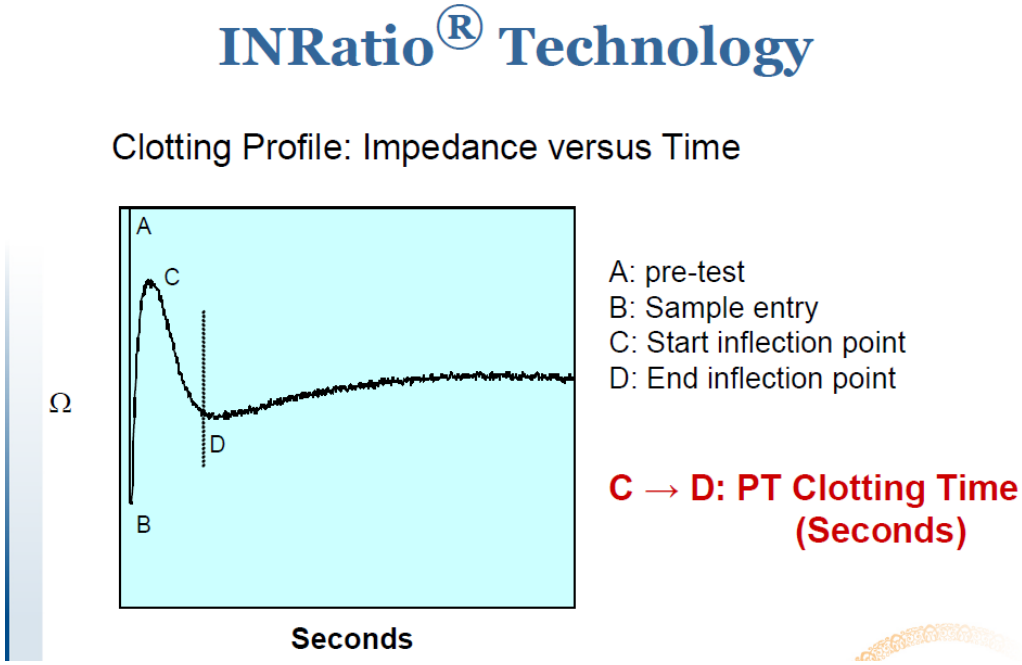


Figure 9: Mechanism of generation of INR



Use of prothrombin time self-monitoring devices are effective in maintaining the INR values within a therapeutic range with improved anticoagulation control. This improvement is thought to be due to several factors but most importantly due to more frequent testing intervals. The complications associated with self-monitoring are similar to what is associated with monitoring by a physician or a specialized clinic. With proper training and support a home testing device is accurate, feasible, and possibly more effective than standard laboratory prothrombin time testing in maintaining anticoagulation control within target therapeutic ranges for conditions requiring long-term anticoagulation.

The FDA approval of home prothrombin time self-monitoring devices is based on the demonstration that home prothrombin monitors produce results similar to laboratory-based measurements. Effective March 19, 2008, the Centers for Medicare and Medicaid Services (CMS) , USA, implemented a National Coverage Determination (NCD) for *Home*

Prothrombin Time Monitoring for Anticoagulation Management.

A Cochrane meta-analysis (Garcia-Alamino, 2010) reported on a pooled estimate of 18 randomized controlled trial (4723 participants), showing significant reductions in both thromboembolic events (risk ratio [RR] 0.50, 95% confidence interval [CI] 0.36 to 0.69) and all-cause mortality (RR 0.64, 95% CI 0.46 to 0.89). Trials of self-management alone showed significant reductions in thromboembolic events (RR 0.47, 95% CI 0.31 to 0.70) and all-cause mortality (RR 0.55, 95% CI 0.36 to 0.84); self-monitoring did not (thrombotic events RR 0.57, 95% CI 0.32 to 1.00; mortality RR 0.84, 95% CI 0.50 to 1.41). Self-monitoring significantly reduced major hemorrhages (RR 0.56, 95% CI 0.35 to 0.91) while self-management did not (RR 1.12, 95% CI 0.78 to 1.61). Twelve trials reported improvements in the percentage of mean INR measurements in the therapeutic range. No heterogeneity was identified in any of these comparisons. The authors concluded

that compared to standard monitoring, individuals who self-monitor or self-manage can improve the quality of their oral anticoagulation therapy. The number of thromboembolic events and mortality were decreased without increases in harms. However, self-monitoring or self-management were not feasible for up to half of the individuals requiring anticoagulant therapy due to refusal to participate, exclusion by their general practitioner, and inability to complete training.

Bloomfield and colleagues (2011) published a meta-analysis and systematic review that included randomized controlled trials in adults comparing home monitoring to monitoring in a medical centre; the studies included adults on long-term (greater than three months) therapy. The systematic review included 22 trials; five on self-monitoring; 14 including self-management. There were significantly fewer major thromboembolic events in the self-monitoring and self-management group- pooled analysis- (99 of 4004 subjects,

2.5%) in contrast to the standard treatment group (149 of 3755 subjects, 4.0%; odds ratio [OR]: 0.58 (95% CI: 0.45 to 0.75). Major bleeding event rate did not differ significantly between the groups. Similar to the Cochrane meta-analysis (Garcia-Alamino, 2010), There was a very low rate of study participation in subjects who satisfied the eligibility criteria. There was no separate analysis of studies with respect to enrollment of inception cohorts.

Heneghan in 2012 published a meta-analysis using a design like the other published metaanalyses. They searched for randomized controlled trials comparing management of oral anticoagulation in adults to physician management. This review did not discuss whether home monitoring was used in the initial three months of anticoagulation therapy. The meta-analysis included data of 6,417 participants from 11 of the 21suitable trials. In a pooled analysis, there was a statistically significant reduction in the thromboembolic event rate in the home monitoring group compared to the standard therapy

group (hazard ratio [HR]: 0.51, 95% CI: 0.31 to 0.85). There was no significant difference in the major hemorrhagic event rate (HR: 0.88, 95% CI: 0.74 to 1.06) or death rate (HR: 0.82, 95% CI: 0.62 to 1.09).

Conclusion

- INRatio accurate for INR testing in an OPD setting only when no reference lab available
- Has moderate overall utility
- Strict clinical agreement not adequate
- Effect in shortening treatment time in our setting not relevant
- No conflict of Interest

Appendix

1. Informed consent form

PATIENT INFORMATION SHEET

1. Study title

Analytical performance of a coagulation monitoring system INRatio for the determination of INR compared with an established laboratory method and its use in shortening patient treatment time in a tertiary care vascular surgery centre.

2. Principal Investigator Dr. Indrani Sen

3. Contact address

Department of Vascular Surgery, Christian Medical College, Vellore 632 004,

India

Email: dr.indranisen@gmail.com

Tel. + 91 416 2282085

This study is a research project conducted in CMC Vellore, departments of Vascular Surgery and Transfusion medicine and immunohaematology. You know that while you are on blood thinners you routinely give a blood test (international normalized ratio- INR) which you require as part of the standard outpatient procedure for treatment.
We want to study a machine for testing INR and see if this will help to get an accurate test result faster than testing in the lab. If you decide to participate in the study, you will be asked to give one drop of blood from a finger prick test. This is the only invasive procedure that you will be subjected to. We will compare the result of this test to the test you have given in the lab to see if both the results are similar.

All precautions necessary will be taken to avoid any complications that may arise due to the finger puncture. Your finger tip will be cleaned with spirit and left to dry. Puncture will be made into the finger tip using a fine needle and a small amount of blood will be collected onto a testing strip. Compression will be applied for 2 minutes to ensure that bleeding has stopped. This is all done as a one time process. Your treatment will be based on the lab test result- the finger prick test result will not be used.

By participating in the study you will not be made to incur any added expenses. There is no added risk of any kind for you by participating in this study. The information generated by this study may not directly benefit you at this time but may benefit later in reducing the waiting time for the blood test result. Any personal information about you that is collected as part of this study will be maintained strictly confidential.

If you have any queries or problems you can contact the principal investigator at the above address. If you choose not to participate, it will not affect your treatment in any way.

INFORMED CONSENT DOCUMENT

I …….(Participant's name), Hosp no…… have fully read and understood the participant's information sheet as given above.

By signing this form I agree that

(1) I understand that the purpose of this study is to improve the quality of medical care and that my involvement may not benefit me.
(2) I have been made aware of the procedures involved in the study and the expected inconvenience, risk, discomfort or potential side effects as far as they are currently known by the researcher.
(3) My participation in this study is fully voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.
(4) I understand that my identity will not be revealed in any information released to third parties or published.
(5) I will not restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s)

I do hereby agree to take part in this study.

Patient Name Signature Date
(or Thumb impression) of the Subject/Legally Acceptable Representative
Investigator Name Signature Date
Witness Name Signature Date

Annexure 2. Data sheet

name	hosp no	age	sex	indicatoin	CMC INR	test INR	qc1	qc2
mumthaz	338985f	20	f	dvt	4.04	3.2	10.1	29.6
sujatha	354936f	20	f	dvt	5.9	lo	lo	lo
sujatha	354936f	20	f	dvt	3.48	3.3	10.1	24.2
balamuruli	828251c	22	m	dvt	1.47	1.1	8.3	17.1
bashirun	270948f	22	f	dvt	4.75	3.9	12.9	21.9
bashirun	270948f	22	f	dvt	3.2	3.4	9.8	15
balamuruli	828251c	22	m	dvt	1.76	1.9	11	21.1
balamuruli	828251c	22	m	dvt	1.6	1.6	8.6	10.3
bashirun	270948f	22	f	dvt	1.78	er	er	er
balamuruli	828251c	22	m	dvt	1.47	1.3	10.7	19.3
balamuruli	828251c	22	m	dvt	1.04	1.2	9.8	18.5
bashirun	270948f	22	f	dvt	1.37	1.4	10.1	18.6
bashirun	270948f	22	f	dvt	1.11	1.6	8.8	13.4
bharati	822687d	25	f	dvt	2.27	2.4	11.6	22.4
pushparaj	087019d	25	m	dvt	1.68	2	10.1	20.7
bharati	822678d	25	f	dvt	1.53	1.8	9.8	18.2
tamilselvi	211676f	27	f	dvt	1.06	1.1	9.8	21.8
tamilselvi	211676f	27	f	dvt	2.35	1.3	10.3	18.8
tamilselvi	211676f	27	f	dvt	1.68	1.8	11.9	20.6
bishwa	283812f	28	m	dvt	1.93	3.7	10.5	20.8
bonnie	307670f	28	m	dvt	2.21	2.1	10.5	17.8
sridevi	177045f	29	f	dvt	1.39	er	er	er
muniyan	291676f	29	m	dvt	2.32	2.1	10.4	23.6
gavaskar	020620c	30	m	dvt	2.28	3.3	9.3	19.9
satish	218318f	30	m	dvt	1.47	1.6	10.8	16.5
pownammal	240618f	30	f	dvt	2.97	4	10.8	13.6
satish	218318f	30	m	dvt	2.15	2.4	10	17.8
gandhi	895860d	31	m	dvt	4.81	4.3	10.5	21.7
laxmi	372675d	32	m	art	2.33	2.7	11.9	21.5
laxmi	372675d	32	m	dvt	2.33	2.5	11.1	17.8
ganesan	308740f	32	m	dvt	1.09	1.3	12.9	11.2
ganesan	308740f	32	m	dvt	1.27	1.3	10.3	17.4

laxmi	372675d	32	m	dvt	0.99	0.8	11.3	18.7
nabamita	243778f	32	f	dvt	1.88	er	er	er
laxmi	372675d	32	m	dvt	3.4	4	10.9	25
laxmi	372675d	32	m	art	2.33	4.5	11.3	20.4
nabamita	243778f	32	f	dvt	2.09	2.3	10.4	22.3
laxmi	372675d	32	m	dvt	2.38	2.6	9.6	16.6
vijayakumar	272570d	33	m	dvt	2.4	2.01	12	27.4
kavitha	251784f	33	f	dvt	1.59	1.6	11.3	19.4
kavitha	251784f	33	f	dvt	5.02	5.4	11.2	21.2
kavitha	251784f	33	f	dvt	1.99	2.1	9.8	25.1
dhanabackiyam	647567b	34	f	dvt	2.52	3.8	11.6	20.4
dhinakaran	665782a	35	m	dvt	2.82	2.2	8.4	17.3
kasthoori	207887f	36	f	dvt	2.06	2	9.3	14.5
mahavishnu	002325f	37	m	dvt	5.58	5.4	11.5	22.7
mahavishnu	002325f	37	m	dvt	1.26	1.6	11.2	19.9
mahavishnu	002325f	37	m	dvt	2.43	2.43	11.8	17.3
siva	240672f	37	m	dvt	3.1	3.3	9.9	18.2
mahavishnu	002325f	37	m	dvt	1.37	er	er	er
mahavishnu	002325f	37	m	dvt	2.66	3.2	10.8	23.1
mahavishnu	002325f	37	m	dvt	1.8	1.7	10.8	16.2
prasad	213249d	38	m	art	1	1.3	8.2	14.6
loganathan	207911f	39	m	dvt	1	1.1	10.2	18.8
manimaran	317705f	39	m	dvt	3.17	7.5	9.4	21.2
vijalakshmi	295538f	40	f	dvt	4	er	er	er
vijalakshmi	295538f	40	f	dvt	2.12	1.6	8.7	17.3
krishnamoorthy	316649f	40	m	dvt	1	1.1	10.5	28.8
vijayalakshmi	295538f	40	f	dvt	2.14	2.1	9.1	18.4
selvam	332419f	40	m	dvt	2.01	2.4	11	21.2
mathiyalagan	537279d	41	m	dd	4.98	er	er	er
mathiyalagan	537279d	41	m	dvt	1.68	2	10.1	19.7
santhi	426298a	42	f	dvt	1.7	2.7	11.5	20
murali	186881f	42	m	dvt	2.15	1.5	12.5	16.2
shanthi	426298a	42	f	dvt	2.29	2.9	10.7	25
muurali	186881f	42	m	dvt	4.15	4	11.7	23
kanagalakshmi	995603c	43	f	dvt	2.85	3.1	12.1	21
damodaran	015112b	43	m	dvt	4.12	3.7	10.2	22
kanagalakshmi	995603c	43	f	dvt	3.42	3.4	10.4	23
jakeer	981899b	43	m	dvt	1.44	1.5	10.1	16.3

dhinakaran	665782a	44	m	art	2.05	0.8	1.5	21.9
dhinakaran	665782a	44	m	art	1.33	1.4	10	18.4
anbu	068453f	45	f	dvt	2.1	2.5	10.1	14.7
rajendran	359827d	46	m	dvt	3.69	3.6	10.4	21.5
shafeeulla	218634f	46	f	dvt	2.32	2.3	10	15
shafeeulla	218634f	46	m	dvt	1.99	2.1	10.2	19.4
shanthi	147616c	46	f	art	2.8	3.2	11.2	20.2
rajendran	359827d	46	m	dvt	3.1	2.9	10.4	18.7
sundari	003222f	46	f	dvt	1.79	2	12.7	21.2
venkatesan	172446f	47	m	dvt	5.47	5.5	11.9	27.7
venkatesan	172446f	47	m	dvt	2.14	2.7	9.2	19.2
muthumani	364833a	47	m	dvt	2	2.5	11.9	19.7
amara	259402f	47	f	dvt	3.4	2.4	10.4	21.7
renuka	335119f	47	f	dvr	1.4	3.2	11.1	17.9
renuka	335119f	47	f	dvt	0.8	1.3	,mn	18.7
ammara	259402f	47	f	dvt	3.01	2.2	10.3	13.7
muthumani	364833a	47	f	dvt	2.3	2.3	9.6	15.8
renuka	335119f	47	f	dvt	2.43	1.4	9.1	2.4
rajendran	347416f	47	m	dvt	2.82	2.2	10.6	22.7
jagadish	351022f	47	m	dvt	3.37	er	er	er
guna	105097d	48	m	dvt	2.38	3.9	9.8	22.5
rrenuka	335119f	48	f	dvt	1.97	1.6	10.5	20.9
vijaya	264482f	49	f	dvt	1.26	er	er	er
jayakumar	118537	49	m	dvt	2.3	2.06	10.6	15.3
gauranga	277992f	49	m	dvt	3.79	1	12.2	22
jagatha	384313f	49	f	art	1.1	1..8	11.5	19.1
jagatha	384313f	49	f	art	5.48	7.1	9.4	17.1
indira	253000f	50	f	dvt	1.7	1.7	12.3	20.9
mangalakshmi	222885f	50	f	dvt	3.48	er	er	er
indira	253000f	50	f	dvt	1.5	er	er	er
indira	253000f	50	f	dvt	1.8	1.9	10.4	22.8
indira	253000f	50	f	dvt	1.77	1.9	10.3	21.4
indira	253000f	50	f	dvt	1.98	1.6	10.6	23.4
jothy	147840f	50	f	dvt	2.47	2.1	10.7	21.1
indira	253000f	50	f	dvt	2.43	2.8	9.9	18.4
kanchana	084314f	51	f	dvt	2.52	2.5	214	11.3
mangalakshmi	222885f	51	f	dvt	1.7	2.2	10.3	13.7
chengalrayalu	005057f	52	m	dvt	0.97	0.9	13.3	26

shakuntala	134933a	52	m	dvt	2.38	2.2	10.4	19.1
ravanamma	592409d	53	f	dvt	2.88	3.9	9.6	17.5
ram gopal	514251d	53	m	art	2.01	2.2	11.8	22.5
mani	264141f	54	m	dvt	4.64	3.8	12.4	21.8
mani	264141f	54	m	dvt	1.07	2.01	11.7	17.3
pradip	056275f	54	m	dvt	1.04	1.3	12.4	21
selvi	407641f	54	f	dvt	3.16	3	12.4	18.6
bhagvan	048920b	54	m	dvt	2.62	3	11.8	20.7
mani	264141f	54	m	dvt	1	1.3	10.7	20.3
rani	312700f	55	m	dvt	1.7	5.2	12.4	24.8
md jafar	171346f	57	m	nephrotic	1.2	er	er	er
anjala	560947	57	f	dvt	1.51	er	er	er
chakrabani	508949c	58	m	dvt	2.41	2.7	11	21.7
venkatesan	925518c	60	m	dvt	1.7	1.8	9.9	18.4
lalitha	726940c	61	f	dvt	1.13	1.8	11.9	19.7
subramaniaam	336635f	61	m	dvt	1.24	1.2	10	14.8
subramaniaam	336635f	61	m	dvt	1.49	1.6	9.7	23.3
subramaniaam	336635f	61	m	dvt	4.63	5.3	10.8	21.5
ramu	406126c	62	m	dvt	1.58	1.9	9.9	17.6
sree	066126a	62	f	dvt	2.3	er	er	er
ramu	406126c	62	m	dvt	1.24	er	er	er
chinna	274461f	63	f	dvt	2.3	2.4	10.5	21
savithri	941028d	64	f	dvt	2.07	1.2	11.2	27.4
selvaraj	894086d	65	m	dvt	2.48	2.7	10.6	22.5
kasiammal	304631f	65	f	dvt	10	4.1	11.3	24.6
manoharan	529289b	65	m	dvt	1.93	2.1	9.5	17.4
setty	174497f	66	m	dvt	1.92	1.9	11.1	21.4
baskaran	018197a	66	m	dvt	2.16	2.2	12	20
setty	174497f	66	m	dvt	1.5	er	er	er
baskaran	018197a	66	m	dvt	2.86	3.4	11	26.8
setty	174497f	66	m	dvt	2.99	hi	hi	hi
narasimha	588068d	66	m	dvt	5.08	5.8	10.3	19.8
lakshmi kantaiah	168300f	67	m	dvt	3.08	1.41	13.7	17.7
sammpooornam	068976c	68	f	dvt	2.05	2.52	11.5	19.3
sammpooornam	068976c	68	f	dvt	2.61	2.4	9.8	21.8
selvaraj	871404a	69	m	dvt	1.5	1.7	10.9	18.9
saroja	533665c	69	f	dvt	1.47	er	er	er
saroja	533665c	70	f	dvt	1.77	2	10.3	15.2

subramaniaam	384688f	70	m	dvt	4.63	3.5	11.3	22.1	
amma	058168d	71	f	dvt	1.5	1.8	9	14.8	
vendabai	280656f	75	f	dvt	2.2	1.5	12.5	21.1	
amara	259402f	47	f	dvt	2.82	2.8	9.9	16.6	
regina	468941d	43	f	art	2.3	2.4	11	19.2	
kumaravel	140137f	36	m	dvt	1.08	1.2	12.4	18.7	
santosh	3016141f	35	m	dvt	3.06	2.6	12.4	18.6	
amara	259402f	47	f	dvt	1.42	1.4	10.4	19.4	
subramaniaam	174497f	66	m	dvt	3.01	3.1	11.5	12.5	
shanti	426298a	42	f	dvt	3.99	3.5	10.7	21.7	
manoharan	529289b	65	m	dvt	2.29	2.4	16.7	25.2	
balu			m	dvt	2.27	2.6	10.6	23	
shanthi	147616c	46	f	art	2.94	2.9	8.4	20.4	
narasimha	588068d	66	m	dvt	3.48	4.8	10.4	20.7	
vendabai	280656f	75	f	dvt	2	2.5	10.2	18.8	
shakuntala	134933a	52	f	dvt	5.9	4	11.6	22.9	
reddy	588068d	66	m	dvt	1.52	1.5	10.6	24.8	
shakuntala	134933a	52	f	dvt	1.19	lo	lo	lo	
reddy	588068d	66	m	dvt	1.52	1.5	10.6	24.8	
gopalakrishna	364466f	25	m	dvt	4.66	4.5	11.7	23	
chinna	274461f	63	m	dvt	1.05	0.8	9.7	18.1	
anbu	068453f	46	m	dvt	2.66	2.1	12	16.4	

name	hosp no	low hb 21/08/2012	age	sex	indicatoin	times needed for result	CMC INR	test INR	qc1	qc2	pt
mumthaz	338985f	la	20	f	dvt	1	4.04	3.2	10.1	29.6	31.
sujatha	354936f		20	f	dvt	2	5.9	lo	lo	lo	lo
sujatha	354936f	9.1	20	f	dvt	1	3.48	3.3	10.1	24.2	32.
balamuruli	828251c		22	m	dvt	1	1.47	1.1	8.3	17.1	10.
bashirun	270948f	6.11.12	22	f	dvt	2	4.75	3.9	12.9	21.9	39.
bashirun	270948f		22	f	dvt	2	3.2	3.4	9.8	15	33.
balamuruli	828251c	30.11?	22	m	dvt	1	1.76	1.9	11	21.1	19
balamuruli	828251c		22	m	dvt	1	1.6	1.6	8.6	10.3	15.
bashirun	270948f	thick skin	22	f	dvt	2	1.78	er	er	er	er
balamuruli	828251c		22	m	dvt	1	1.47	1.3	10.7	19.3	14.
balamuruli	828251c	low hb	22	m	dvt	1	1.04	1.2	9.8	18.5	11.
bashirun	270948f		22	f	dvt	1	1.37	1.4	10.1	18.6	14.

bashirun	270948f	nephrotic	22	f	dvt	1	1.11	1.6	8.8	13.4	16.
bharati	822687d		25	f	dvt	1	2.27	2.4	11.6	22.4	24.
pushparaj	087019d	low hb	25	m	dvt	1	1.68	2	10.1	20.7	48.
bharati	822678d		25	f	dvt	1	1.53	1.8	9.8	18.2	18.
tamilselvi	211676f	thick skin	27	f	dvt	1	1.06	1.1	9.8	21.8	23.
tamilselvi	211676f		27	f	dvt	1	2.35	1.3	10.3	18.8	13.
tamilselvi	211676f	28/08/2012	27	f	dvt	1	1.68	1.8	11.9	20.6	17.
bishwa	283812f		28	m	dvt	1	1.93	3.7	10.5	20.8	3.3
bonnie	307670f	thick skin	28	m	dvt	1	2.21	2.1	10.5	17.8	21.
sridevi	177045f		29	f	dvt	2	1.39	er	er	er	er
muniyan	291676f	thick skin	29	m	dvt	1	2.32	2.1	10.4	23.6	21.
indrajit	120897d		30	m	art	1	2.3	2.7	11.7	23.8	27.
gavaskar	020620c		30	m	dvt	1	2.28	3.3	9.3	19.9	32.
satish	218318f		30	m	dvt	1	1.47	1.6	10.8	16.5	15.
pownammal	240618f		30	f	dvt	1	2.97	4	10.8	13.6	40.
satish	218318f		30	m	dvt	1	2.15	2.4	10	17.8	23.
gandhi	895860d		31	m	dvt	1	4.81	4.3	10.5	21.7	43
laxmi	372675d		32	m	art	1	2.33	2.7	11.9	21.5	27.
laxmi	372675d		32	m	dvt	1	2.33	2.5	11.1	17.8	25
ganesan	308740f		32	m	dvt	1	1.09	1.3	12.9	11.2	17.
ganesan	308740f		32	m	dvt	1	1.27	1.3	10.3	17.4	13.
laxmi	372675d		32	m	dvt	1	0.99	0.8	11.3	18.7	8.3
nabamita	243778f		32	f	dvt	2	1.88	er	er	er	er
laxmi	372675d		32	m	dvt	1	3.4	4	10.9	25	39.
laxmi	372675d		32	m	art	1	2.33	4.5	11.3	20.4	23.
nabamita	243778f		32	f	dvt	1	2.09	2.3	10.4	22.3	22.
laxmi	372675d		32	m	dvt	1	2.38	2.6	9.6	16.6	19.
vijayakumar	272570d		33	m	dvt	1	2.4	2.01	12	27.4	23.
kavitha	251784f		33	f	dvt	1	1.59	1.6	11.3	19.4	15.
kavitha	251784f		33	f	dvt	1	5.02	5.4	11.2	21.2	54.
kavitha	251784f		33	f	dvt	1	1.99	2.1	9.8	25.1	21.
dhanabackiyam	647567b		34	f	dvt	1	2.52	3.8	11.6	20.4	38.
sharmila	196250f		35	f	dvt	1	4.79	5.3	12.3	21.5	36.
sharmila	196250f		35	f	dvt	2	3.24	er	er	er	er
dhinakaran	665782a		35	m	dvt	1	2.82	2.2	8.4	17.3	21.
kasthoori	207887f		36	f	dvt	1	2.06	2	9.3	14.5	20.
mahavishnu	002325f		37	m	dvt	1	5.58	5.4	11.5	22.7	54.
mahavishnu	002325f		37	m	dvt	1	1.26	1.6	11.2	19.9	15.

mahavishnu	002325f		37	m	dvt	1	2.43	2.43	11.8	17.3	38.
siva	240672f		37	m	dvt	1	3.1	3.3	9.9	18.2	32.
mahavishnu	002325f		37	m	dvt	1	1.37	er	er	er	er
mahavishnu	002325f		37	m	dvt	1	2.66	3.2	10.8	23.1	31.
mahavishnu	002325f		37	m	dvt	1	1.8	1.7	10.8	16.2	18.
prasad	213249d		38	m	art	1	1	1.3	8.2	14.6	13.
loganathan	207911f		39	m	dvt	1	1	1.1	10.2	18.8	10.
manimaran	317705f		39	m	dvt	1	3.17	7.5	9.4	21.2	hi
vijalakshmi	295538f		40	f	dvt	2	4	er	er	er	er
vijalakshmi	295538f		40	f	dvt	1	2.12	1.6	8.7	17.3	16.
krishnamoorthy	316649f		40	m	dvt	1	1	1.1	10.5	28.8	10.
vijayalakshmi	295538f		40	f	dvt	1	2.14	2.1	9.1	18.4	20.
selvam	332419f		40	m	dvt	1	2.01	2.4	11	21.2	24.
mathiyalagan	537279d		41	m	dd	2	4.98	er	er	er	er
mathiyalagan	537279d		41	m	dvt	1	1.68	2	10.1	19.7	23.
santhi	426298a		42	f	dvt	1	1.7	2.7	11.5	20	27.
murali	186881f		42	m	dvt	1	2.15	1.5	12.5	16.2	14.
shanthi	426298a		42	f	dvt	1	2.29	2.9	10.7	25	28.
muurali	186881f		42	m	dvt	1	4.15	4	11.7	23	44
kanagalakshmi	995603c		43	f	dvt	1	2.85	3.1	12.1	21	3.7
damodaran	015112b		43	m	dvt	1	4.12	3.7	10.2	22	36.
kanagalakshmi	995603c		43	f	dvt	1	3.42	3.4	10.4	23	33.
jakeer	981899b		43	m	dvt	1	1.44	1.5	10.1	16.3	14.
dhinakaran	665782a		44	m	art	1	2.05	0.8	1.5	21.9	7.9
dhinakaran	665782a		44	m	art	1	1.33	1.4	10	18.4	13.
anbu	068453f		45	f	dvt	1	2.1	2.5	10.1	14.7	24.
rajendran	359827d		46	m	dvt	1	3.69	3.6	10.4	21.5	36.
shafeeulla	218634f		46	f	dvt	1	2.32	2.3	10	15	23.
shafeeulla	218634f		46	m	dvt	1	1.99	2.1	10.2	19.4	21
shanthi	147616c		46	f	art	1	2.8	3.2	11.2	20.2	31.
rajendran	359827d		46	m	dvt	1	3.1	2.9	10.4	18.7	28.
sundari	003222f		46	f	dvt	1	1.79	2	12.7	21.2	19.
venkatesan	172446f		47	m	dvt	1	5.47	5.5	11.9	27.7	54.
venkatesan	172446f		47	m	dvt	1	2.14	2.7	9.2	19.2	27.
muthumani	364833a		47	m	dvt	1	2	2.5	11.9	19.7	25
amara	259402f		47	f	dvt	1	3.4	2.4	10.4	21.7	24.
renuka	335119f		47	f	dvr	1	1.4	3.2	11.1	17.9	14.
renuka	335119f		47	f	dvt	1	0.8	1.3	,mn	18.7	13.

ammara	259402f		47	f	dvt	1	3.01	2.2	10.3	13.7	22.
muthumani	364833a		47	f	dvt	1	2.3	2.3	9.6	15.8	22.
renuka	335119f		47	f	dvt	1	2.43	1.4	9.1	2.4	14.
rajendran	347416f		47	m	dvt	1	2.82	2.2	10.6	22.7	21.
jagadish	351022f		47	m	dvt	2	3.37	er	er	er	er
saraswathy	987330d		48	f	dvt	1	2.3	2.7	11.7	23.8	27
guna	105097d		48	m	dvt	1	2.38	3.9	9.8	22.5	39
rrenuka	335119f		48	f	dvt	1	1.97	1.6	10.5	20.9	15.
vijaya	264482f		49	f	dvt	2	1.26	er	er	er	er
vijaya	264482f		49	f	dvt	2	1.26	er	er	er	er
jayakumar	118537		49	m	dvt	1	2.3	2.06	10.6	15.3	22.
gauranga	277992f		49	m	dvt	1	3.79	1	12.2	22	9.9
jagatha	384313f		49	f	art	1	1.1	1..8	11.5	19.1	17.
jagatha	384313f		49	f	art	1	5.48	7.1	9.4	17.1	71.
indira	253000f		50	f	dvt	1	1.7	1.7	12.3	20.9	17.
mangalakshmi	222885f		50	f	dvt	1	3.48	er	er	er	er
indira	253000f		50	f	dvt	2	1.5	er	er	er	er
indira	253000f		50	f	dvt	1	1.8	1.9	10.4	22.8	14.
indira	253000f		50	f	dvt	1	1.77	1.9	10.3	21.4	18.
indira	253000f		50	f	dvt	1	1.98	1.6	10.6	23.4	14.
jothy	147840f		50	f	dvt	1	2.47	2.1	10.7	21.1	20.
indira	253000f		50	f	dvt	1	2.43	2.8	9.9	18.4	28
kanchana	084314f		51	f	dvt	1	2.52	2.5	214	11.3	24.
mangalakshmi	222885f		51	f	dvt	1	1.7	2.2	10.3	13.7	22.
chengalrayalu	005057f		52	m	dvt	1	0.97	0.9	13.3	26	8.6
shakuntala	134933a		52	m	dvt	1	2.38	2.2	10.4	19.1	22.
ravanamma	592409d		53	f	dvt	1	2.88	3.9	9.6	17.5	38.
ram gopal	514251d		53	m	art	1	2.01	2.2	11.8	22.5	22.
mani	264141f		54	m	dvt	1	4.64	3.8	12.4	21.8	38.
mani	264141f		54	m	dvt	1	1.07	2.01	11.7	17.3	19.
mani	264141f		54	m	dvt	1	1.6	1.6	11.3	19.7	164
pradip	056275f		54	m	dvt	1	1.04	1.3	12.4	21	12.
selvi	407641f		54	f	dvt	1	3.16	3	12.4	18.6	26.
bhagvan	048920b		54	m	dvt	1	2.62	3	11.8	20.7	30.
mani	264141f		54	m	dvt	1	1	1.3	10.7	20.3	13.
rani	312700f		55	m	dvt	1	1.7	5.2	12.4	24.8	51.
md jafar	171346f		57	m	nephrotic	2	1.2	er	er	er	er
anjala	560947		57	f	dvt	2	1.51	er	er	er	er

chakrabani	508949c		58	m	dvt	1	2.41	2.7	11	21.7	27.
venkatesan	925518c		60	m	dvt	1	1.7	1.8	9.9	18.4	18.
lalitha	726940c		61	f	dvt	1	1.13	1.8	11.9	19.7	25
subramaniaam	336635f		61	m	dvt	1	1.24	1.2	10	14.8	11.
subramaniaam	336635f		61	m	dvt	1	1.49	1.6	9.7	23.3	15.
subramaniaam	336635f		61	m	dvt	1	4.63	5.3	10.8	21.5	63.
ramu	406126c		62	m	dvt	1	1.58	1.9	9.9	17.6	18.
sree	066126a		62	f	dvt	2	2.3	er	er	er	er
ramu	406126c		62	m	dvt	2	1.24	er	er	er	er
chinna	274461f		63	f	dvt	1	2.3	2.4	10.5	21	23
savithri	941028d		64	f	dvt	1	2.07	1.2	11.2	27.4	12.
selvaraj	894086d		65	m	dvt	1	2.48	2.7	10.6	22.5	26.
kasiammal	304631f		65	f	dvt	1	10	4.1	11.3	24.6	40.
manoharan	529289b		65	m	dvt	1	1.93	2.1	9.5	17.4	21.
setty	174497f		66	m	dvt	1	1.92	1.9	11.1	21.4	18.
baskaran	018197a		66	m	dvt	1	2.16	2.2	12	20	22.
setty	174497f		66	m	dvt	2	1.5	er	er	er	er
baskaran	018197a		66	m	dvt	1	2.86	3.4	11	26.8	33.
setty	174497f		66	m	dvt	1	2.99	hi	hi	hi	hi
narasimha	588068d		66	m	dvt	1	5.08	5.8	10.3	19.8	57.
lakshmi kantaiah	168300f		67	m	dvt	1	3.08	1.41	13.7	17.7	13.
sammpooornam	068976c		68	f	dvt	1	2.05	2.52	11.5	19.3	24.
sammpooornam	068976c		68	f	dvt	1	2.61	2.4	9.8	21.8	22.
selvaraj	871404a		69	m	dvt	1	1.5	1.7	10.9	18.9	17.
saroja	533665c		69	f	dvt	2	1.47	er	er	er	er
saroja	533665c		70	f	dvt	1	1.77	2	10.3	15.2	19.
subramaniaam	384688f		70	m	dvt	1	4.63	3.5	11.3	22.1	34.
amma	058168d		71	f	dvt	1	1.5	1.8	9	14.8	18.
vendabai	280656f		75	f	dvt	1	2.2	1.5	12.5	21.1	15.
amara	259402f		47	f	dvt	1	2.82	2.8	9.9	16.6	27.
regina	468941d		43	f	art	1	2.3	2.4	11	19.2	24.
kumaravel	140137f		36	m	dvt	1	1.08	1.2	12.4	18.7	11.
santosh	3016141f		35	m	dvt	1	3.06	2.6	12.4	18.6	26.
amara	259402f		47	f	dvt	1	1.42	1.4	10.4	19.4	14.
subramaniaam	174497f		66	m	dvt	1	3.01	3.1	11.5	12.5	30.
manoharan	529289b		65	m	dvt	1	10	er	er	er	er
shanti	426298a		42	f	dvt	1	3.99	3.5	10.7	21.7	21.

manoharan	529289b		65	m	dvt	1	2.29	2.4	16.7	25.2	24.
balu				m	dvt		2.27	2.6	10.6	23	25.
shanthi	147616c		46	f	art	1	2.94	2.9	8.4	20.4	29.
narasimha	588068d		66	m	dvt	1	3.48	4.8	10.4	20.7	48.
vendabai	280656f		75	f	dvt	1	2	2.5	10.2	18.8	24.
shakuntala	134933a		52	f	dvt	1	5.9	4	11.6	22.9	40
reddy	588068d		66	m	dvt	1	1.52	1.5	10.6	24.8	15.
shakuntala	134933a		52	f	dvt	2	1.19	lo	lo	lo	lo
reddy	588068d		66	m	dvt	1	1.52	1.5	10.6	24.8	15.
gopalakrishna	364466f		25	m	dvt	1	4.66	4.5	11.7	23	44.
chinna	274461f		63	m	dvt	1	1.05	0.8	9.7	18.1	8.4
anbu	068453f		46	m	dvt	1	2.66	2.1	12	16.4	21.

References

1. Rose AJ, Ozonoff A, Berlowitz DR, Ash AS, Reisman JI, Hylek EM. Reexamining the recommended follow-up interval after obtaining an in-range international normalized ratio value: results from the Veterans Affairs study to improve anticoagulation. Chest. 2011 Aug;140(2):359–65.

2. Taborski U, Braun SL, Völler H. Analytical performance of the new coagulation monitoring system INRatio for the determination of INR compared with the coagulation monitor Coaguchek S and an established laboratory method. J. Thromb. Thrombolysis. 2004 Oct;18(2):103–7.

3. Christensen TD, Larsen TB. Precision and accuracy of point-of-care testing coagulometers used for self-testing and self-management of oral anticoagulation therapy. J. Thromb. Haemost. 2012 Feb;10(2):251–60.

4. Azarnoush K, Camilleri L, Aublet-Cuvelier B, Geoffroy E, Dauphin C, Dubray C, et al. Results of the first randomized French study evaluating self-testing of the International Normalized Ratio. J. Heart Valve Dis. 2011 Sep;20(5):518–25.

5. Heneghan C, Ward A, Perera R, Bankhead C, Fuller A, Stevens R, et al. Self-monitoring of oral anticoagulation: systematic review and meta-analysis of individual patient data. Lancet. 2012 Jan 28;379(9813):322–34.

6. Smith M, Harrison D, Ripley T, Grace S, Bronze MS, Jackson R. Warfarin Management Using Point-of-Care Testing in a University-Based Internal Medicine Resident Clinic. Am. J. Med. Sci. 2012 Oct;344(4):289–93.

Welcome to your new class homepage! From the class homepage you can see all your assignments for your class, view additional assignment information, submit your work, and access feedback for your papers.

Hover on any item in the class homepage for more information.

Class Homepage

This is your class homepage. To submit to an assignment click on the "Submit" button to the right of the assignment name. If the Submit button is grayed out, no submissions can be made to the assignment. If resubmissions are allowed the submit button will read "Resubmit" after you make your first submission to the assignment. To view the paper you have submitted, click the "View" button. Once the assignment's post date has passed, you will also be able to view the feedback left on your paper by clicking the "View" button.

Assignment Inbox: The Tamil Nadu Dr. M.G.R. Medical University

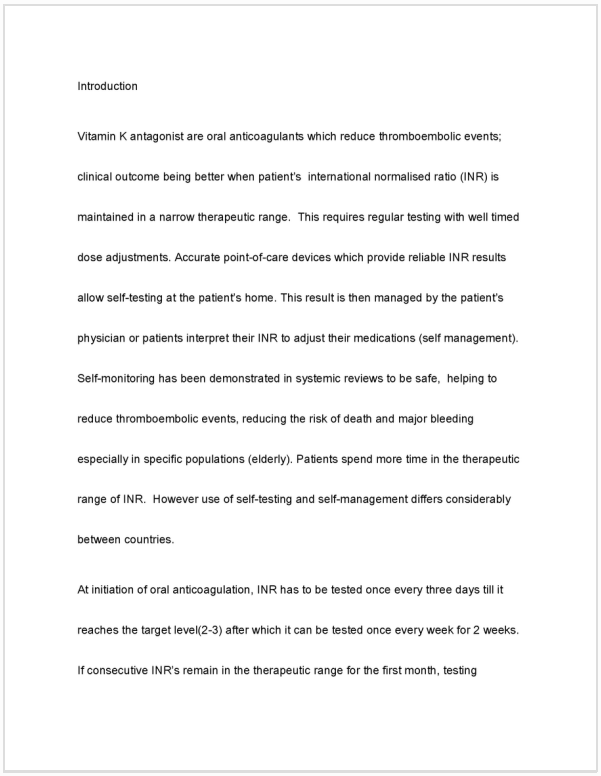
	Info	Dates	Similarity			
Medical	ⓘ	Start 13-Nov-2013 12:50PM Due 31-Mar-2014 11:59PM Post 13-Nov-2013 3:00PM	24%	Resubmit	View	

Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author:	18114751 . M.Ch. Vascular Surgery INDRANI SEN . ARUNKUMARSEN
Assignment title:	Medical
Submission title:	inr5
File name:	inr5.txt
File size:	34.37K
Page count:	28
Word count:	3,888
Character count:	21,403
Submission date:	12-Mar-2014 12:21AM
Submission ID:	378173464



Introduction

Vitamin K antagonist are oral anticoagulants which reduce thromboembolic events; clinical outcome being better when patient's international normalised ratio (INR) is maintained in a narrow therapeutic range. This requires regular testing with well timed dose adjustments. Accurate point-of-care devices which provide reliable INR results allow self-testing at the patient's home. This result is then managed by the patient's physician or patients interpret their INR to adjust their medications (self management). Self-monitoring has been demonstrated in systemic reviews to be safe, helping to reduce thromboembolic events, reducing the risk of death and major bleeding especially in specific populations (elderly). Patients spend more time in the therapeutic range of INR. However use of self-testing and self-management differs considerably between countries.

At initiation of oral anticoagulation, INR has to be tested once every three days till it reaches the target level(2-3) after which it can be tested once every week for 2 weeks. If consecutive INR's remain in the therapeutic range for the first month, testing

INSTITUTIONAL REVIEW BOARD (IRB)
CHRISTIAN MEDICAL COLLEGE
VELLORE 632 002, INDIA

Ref: Res/04/2012

October 22, 2012

Dr. Indrani Sen
Department of Vascular Surgery
Christian Medical College
Vellore 632 004

Sub: **Fluid Research grant project NEW PROPOSAL:**
Analytical performance of a coagulation monitoring system INRation (point of care) for the determination of INR compared with an established laboratory method and its use in shortening patient treatment time in a tertiary care vascular surgery centre.
Dr. Indrani Sen, Vascular surgery, Dr. Edwin Stephen, Dr. Sukesh C Nair, Transfusion Medicine and Immunohaematology

Ref: IRB Min. No. 7847 dated 25.04.2012

22x920
2

I enclose the following documents:-

1. Institutional Review Board approval
2. Agreement

Could you please sign the agreement and send it to Dr. Nihal Thomas, Addl. Vice Principal (Research), so that the grant money can be released.

With best wishes,

Dr. Nihal Thomas
Secretary (Ethics Committee)
Institutional Review Board

CC: Dr. Edwin Stephen, Professor, Department of Vascular Surgery, CMC

TEL : 0416 - 2284294, 2284202 FAX : 0416 - 2262788, 2284481 E-mail : research@cmcvellore.ac.in

INSTITUTIONAL REVIEW BOARD (IRB)
CHRISTIAN MEDICAL COLLEGE
VELLORE 632 002, INDIA

Dr. George Thomas, D Ortho
Editor, Indian Journal of Medical Ethics
Chairperson, Ethics Committee

Dr. L. Jeyaseelan, MSc, PhD
Secretary, Research Committee, IRB

Dr. Alfred Job Daniel, MS Ortho
Chairperson, Research Committee &
Principal

Dr. Nihal Thomas
MD MNAMS, DNB(Endo), FRACP(Endo), FRCP(E
Deputy Chairperson
Secretary, Ethics Committee, IRB
Additional Vice Principal (Research)

October 22, 2012

Dr. Indrani Sen
Department of Vascular Surgery
Christian Medical College
Vellore 632 004

Sub: **Fluid Research grant project NEW PROPOSAL:**
Analytical performance of a coagulation monitoring system INRation (point of care) for the determination of INR compared with an established laboratory method and its use in shortening patient treatment time in a tertiary care vascular surgery centre.
Dr. Indrani Sen, Vascular surgery, Dr. Edwin Stephen, Dr. Sukesh C Nair, Transfusion Medicine and Immunohaematology

Ref: IRB Min. No. 7847 dated 25.04.2012

Dear Dr. Indrani Sen,

The Institutional Review Board (Silver, Research and Ethics Committee) of the Christian Medical College, Vellore, reviewed and discussed your project titled "Analytical performance of a coagulation monitoring system INRation (point of care) for the determination of INR compared with an established laboratory method and its use in shortening patient treatment time in a tertiary care vascular surgery centre" on April 25, 2012.

The Committees reviewed the following documents:

1. Format for application to IRB submission
2. Patient Information and Consent Form (English, Tamil and Hindi)
3. Cvs of Drs. Indrani Sen, Edwin Stephen, Sukesh Nair
4. A CD containing documents 1 – 3

The following Institutional Review Board (Ethics Committee) members were present at the meeting held on April 25, 2012 in the CREST/SACN Conference Room, Christian Medical College, Bagayam, Vellore 632002.

TEL : 0416 - 2284294, 2284202 FAX : 0416 - 2262788, 2284481 E-mail : research@cmcvellore.ac.in

Dr. George Thomas, D Ortho
Editor, Indian Journal of Medical Ethics
Chairperson, Ethics Committee

Dr. L. Jeyaseelan, MSc, PhD
Secretary, Research Committee, IRB

Dr. Alfred Job Daniel, MS Ortho
Chairperson, Research Committee &
Principal

Dr. Nihal Thomas
MD MNAMS, DNB(Endo), FRACP(Endo), FRCP(Edi
Deputy Chairperson
Secretary, Ethics Committee, IRB
Additional Vice Principal (Research)

Name	Qualification	Designation	Other Affiliations
Dr. George Thomas	MBBS, D Ortho	Chairperson (IRB) & Orthopaedic Surgeon, St. Isabel Hospital, Chennai & Former Editor, Indian Journal of Medical Ethics	External
Dr. DJ Christopher	BSc, MBBS, DTCD, DNB, FCCP	Professor of Pulmonary Medicine, CMC	
Dr. Jayaprakash Muliyil	BSC, MBBS, MD, MPH, DrPH(Epid), DMHC	Academic Officer, CMC	
Mr. Samuel Abraham	MA, PGDBA, PGDPM, M.Phil, BL.	Legal Advisor, CMC.	
Mrs. Mary Johnson	M.Sc	Professor of Maternity Nursing, CMC.	
Dr. Vathsala Sadan	M.Sc, Ph.D	Professor of Community Health Nursing, CMC	
Dr. P. Zachariah	MBBS, PhD	Retired Professor , Vellore	External
Mrs. S. Pattabiraman	BSc, DSSA	Social Worker, Vellore	External
Dr. Nihal Thomas	MD MNAMS DNB(Endo)FRACP (Endo) FRCP(Edin)	Secretary IRB (EC)& Dy. Chairperson (IRB), Professor of Endocrinology & Addl. Vice Principal (Research), CMC.	

We approve the project to be conducted as presented.

The Institutional Review Board expects to be informed about the progress annually of the project, any serious adverse events occurring in the course of the project, any changes in the protocol and the patient information/informed consent and requires a copy of the final report.

TEL : 0416 - 2284294, 2284202 FAX : 0416 - 2262788, 2284481 E-mail : research@cmcvellore.ac.in

A sum of ₹ 60,000/- (Rupees Forty thousand only) will be sanctioned for 18 months.

Yours sincerely,

Dr. Nihal Thomas
Secretary (Ethics Committee)
Institutional Review Board

Dr Nihal Thomas
MBBS MD MNAMS DNB (Endo) FRACP(Endo) FRCP(Edin)
Secretary (Ethics Committee)
Institutional Review Board

CC: Dr. Edwin Stephen, Professor, Department of Vascular Surgery, CMC

TEL : 0416 - 2284294, 2284202 FAX : 0416 - 2262788, 2284481 E-mail : research@cmcvellore.ac.in

CHRISTIAN MEDICAL COLLEGE; VELLORE

AGREEMENT TO BE SIGNED BEFORE RELEASE OF ANY RESEARCH GRANT

*****

1. I understand that the research grant is sanctioned only for the specific project approved by the Institutional Review Board and should be used exclusively for this project

2. I note that the project will become operational with effect from the date on which the grant is received, and I agree to complete it within the stipulated time of 18 months.

3. I agree to submit promptly and regularly, the periodical (Half Yearly for One Year Project/Annually for Two years project) reports and the final report of the work done, in the approved format.

4. If I plan to leave the institution before the completion of the project. I will submit a complete and detailed report of the work done by me on the project till the date of relief and transfer the project, either to the Guide or to the Co-Investigator for completion and submission of the Final Report.

5. I agree that any publication arising out of this project will carry an acknowledgement of the financial support of the Christian Medical College Fluid Research Fund

PRINCIPAL

Dr. Indrani Sen
Vascular Surgery

Dr. Edwin Stephen
Vascular Surgery

Project Title: Analytical performance of a coagulation monitoring system INRation (point of care) for the determination of INR compared with an established laboratory method and its use in shortening patient treatment time in a tertiary care vascular surgery centre.

Ref: IRB Min. No. 7847 dated 25.04.2012